COLEOPTERA AND DIPTERA COLLECTED FROM A NEW JERSEY SHEEP PASTURE[1]

BY J. W. WILSON

Domestic animals are known to harbor large numbers of parasitic worms, some species of which, notably among the tapeworms, have unknown life histories with probable intermediate stages in insects. Hall (1929) in a recent paper on "Arthropods as Intermediate Hosts of Helminths" lists thirty-four species of insects which serve as intermediate hosts of Cestoda, fifty-three for Trematoda, one hundred and forty-one for Nematoda, and fifteen for Acanthocephala. Members of the orders Coleoptera and Diptera appear most frequently in such a list, with Siphonaptera, Lepidoptera, Odonata, Mallophaga, Dermaptera, Trichoptera, and Ephemerida also represented. Insect collections with special reference to those found in the dung of various domestic animals, thus serve as a method of orienting research on the life histories of certain of the helminths parasitizing such animals.

During the summer of 1928, from early May to early September, collections of insects, with particular reference to those breeding and found about sheep dung, were made from the sheep pastures and buildings at the Rockefeller Institute for Medical Research at Princeton, New Jersey. The effort was made to conduct a thorough survey of the coleopterous and dipterous fauna in such an environment. The collections show forty-three species of Coleoptera belonging to seven families, and sixty-four species of Diptera belonging to twenty-two families. During the course of the study it was found that very little information about the life history of many of these insects is available. Since a knowledge of their life histories is necessary in working out the life history of parasitic worms for which some of these insects may act as intermediate hosts, notes collected during the summer are included.

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The Diptera were identified by Mr. C. W. Johnson, of The Boston Society of Natural History, and the Staphylinidae by Mr. W. J. Brown, of The Bureau of Entomology, Ottawa, Canada. I wish to acknowledge my indebtedness to these workers for their assistance, as well to Dr. Norman R. Stoll, of The Rockefeller Institute, whose interest stimulated this investigation.

LIST OF COLEOPTERA COLLECTED

(* rare; ** moderately abundant; *** abundant)

Carabidæ

* *Stenolophus dissimilis* Dej.

Hydrophilidæ

* *Phaenonotum estriatum* Say (May, June)
** *Sphaeridium scarabaeoides* Linn. (May, June)
** *Sphaeridium bipustulatum* Fabr. (May, June)
*** *Cercyon praetextatus* Say (May to Sept.)
*** *Cercyon haemorrhoidalis* Fabr. (May to Sept.)
*** *Cercyon pygmaeus* Illig. (May to Sept.)

Staphylinidæ

* *Olophrum obtectum* Er. (May)
* *Oxytelus insignitus* Grav. (May)
* *Stenus punctatus* Er. (May, June)
* *Paederus littorarius* Grav. (May)
* *Aderocharis corticinus* Grav. (June)
* *Trachysectus confluentus* Say (May, June)
* *Stilicus latiusculus* Csy. (May)
*** *Gyrohypnus obsidanus* Melsh. (May, June)
** *Gyrohypnus hamatus* Say (May, June)
* *Gyrohypnus* sp. (May)
* *Neobisnius sobrinus* Er. (May)
* *Philonthus discoideus* Grav. (May)
* *Philonthus micans* Grav. (May)
* *Philonthus cunctans* Horn (June)
* *Philonthus brunneus* Grav. (June, July)
* *Belonchus formosus* Grav. (June)
** *Staphylinus cinnamopterus* Grav. (May, June)

* *Quedius molochinus* Grav. (May)
*** *Quedius capucinus* Grav. (May to Sept.)
* *Tachinus limbatus* Melsh. (May)
* *Erchomus ventriculus* Say (May)

Histeridæ

* *Hister curtatus* Lec. (May, June)
* *Hister americanus* Payk. (May, June)

Byrrhidæ

* *Byrrhus americanus* Lec. (May)

Nitidulidæ

* *Glischrochilus fasciatus* Oliv. (May, June)

Scarabaeidæ

*** *Onthophagus hecate* Panz. (May to Sept.)
*** *Onthophagus pennsylvanicus* Har. (June to Sept.)
* *Aphodius fossor* Linn. (May)
* *Aphodius erraticus* Linn. (May)
*** *Aphodius fimetarius* Linn. (May to Sept.)
*** *Aphodius granarius* Linn. (May to Sept.)
** *Aphodius stercorosus* Melsh. (May to Sept.)
*** *Aphodius distinctus* Mull. (May to Sept.)
* *Aphodius terminalis* Say (July to Sept.)
*** *Ataenius cognatus* Lec. (May to Sept.)
* *Trox insularis* Chev. (May)

NOTES ON COLEOPTERA COLLECTED

Carabidæ

Most of the members of this family are predacious in habit, living upon other insects. Only one species, *Stenolophus dissimilis,* was captured under the dry sheep dung, and this species was very scarce. Only a few specimens were taken during the early part of the summer.

Hydrophilidæ

The majority of the members of this family are aquatic in habit. One subfamily, however, is terrestrial, living in moist

soil and dung. Representatives of three genera of the subfamily Sphæridiinæ were captured in sheep dung and dung mixed with straw bedding. The dung and bedding had been piled in a very moist place for about a week when it was first examined. A few specimens of *Phænonotum estriatum* were captured in this pile of bedding during the early part of the summer. Specimens of *Sphæridium scarabæoides* and *S. bipustulatum* were also taken in large numbers from this wet bedding during the early part of the summer but were never found under the dung in the pasture. All three species of the genus *Cercyon* were abundant in both the wet bedding and the dung in the pasture throughout the season.

Staphylinidæ

The members of this family usually feed upon decaying animal and vegetable matter. Many of the forms listed here were taken early in May from a pile of bedding which had remained undisturbed through the winter in the pasture. It appeared that these forms had overwintered in this old bedding. *Gyrohypnus obsidanus, G. hamatus, Staphylinus cinnamopterus,* and *Quedius capucinus* were the most abundant of the Staphylinidæ. These four species were taken both in the dung and the wet discarded bedding, but the first three were only captured during the early part of the season while the latter was present during the whole of the summer.

Histeridæ

This family of beetles includes about four hundred species described from America which are usually found about carrion and decaying substances. The two species, *Hister curtatus* and *H. americanus* were only occasionally found in the sheep dung during May and June.

Byrrhidæ

The Byrrhidæ are usually found at the roots of trees and grass; a few live under the bark of trees. Only one specimen of *Byrrhus americanus* was captured on May 4 in the pile of old bedding which had been left in the pasture through the winter.

Nitidulidæ

Most of the species of this family feed on the sap of trees, but a few are found on fungi or carrion. *Glischrochilus fasciatus*

was collected in small numbers in the very moist portions of the discarded bedding during the latter part of May and early June.

Scarabæidæ

Representatives of four genera of this very large family were found in the sheep dung and discarded bedding. *Onthophagus hecate* was abundant in the dung, but the eggs were laid in small pellets which were placed in shallow tunnels just beneath the dung pile. This species was present in large numbers during the entire summer. *Onthophagus pennsylvanicus,* the smaller of the two species, was first taken in June but it was more abundant during the latter part of the season. Like *O. hecate, O. pennsylvanicus* places its eggs in pellets of dung which are taken into shallow tunnels beneath the dung piles.

Seven species of *Aphodius* were collected in the sheep dung and discarded bedding. Only a few specimens of *A. fossor* and *A. erraticus* were taken from the wet discarded bedding during the latter part of May. *A. granarius* and *A. fimetarius* were abundant during the whole season, and were taken from cow, horse, and rabbit dung on the Institute farm as well as from the sheep dung. *A. distinctus* was rather abundant from May to September, while *A. stercorosus* was more abundant during the latter part of the summer. *A. terminalis* was not collected until the latter part of the summer. *Atœnius cognatus* was very abundant during most of the season. Only one specimen of *Trox insularis* was collected on May 8 in the old bedding left from the previous year.

Notes on the Life History of Aphodius

During the first and second weeks of May collections were made in the pasture used the previous year for sheep. In one corner of the pasture an old pile of bedding had been allowed to remain undisturbed throughout the winter. Large numbers of *Aphodius granarius* and *A. fimetarius* were found hibernating in this old bedding. These were the only species of *Aphodius* found overwintering in the sheep pasture.

On May 16 many specimens of *A. granarius* and *A. fimetarius* were collected under the fresh sheep droppings in the adjoining

pasture. The first specimens of *A. distinctus* were also taken on May 16 under the fresh droppings. The dung hills were examined daily but it was not until May 28 that *A. stercorosus* was taken. On the same date a pile of bedding, which had been removed from the pens for about a week, was examined and a few specimens of *A. fossor* and *A. erraticus* were collected. These two latter species were never taken in the pasture under the dung. *A. granarius* and *A. fimetarius* were the first of the seven species of *Aphodius* to appear in the sheep pasture, and *A. granarius* was the most abundant of all the species throughout the entire season.

Several pair of *A. granarius* and *A. fimetarius* were taken into the laboratory and placed in pill boxes with a small pellet of dung. Only a few individuals of *A. fimetarius* were reared, and these individuals passed through the different stages of their life cycle in approximately the same time as required by *A. granarius*.

On June 2 eggs of *A. granarius* were found in the pasture. These eggs were taken into the laboratory where they hatched on June 4, but no larvæ were observed in the pasture until June 8. The first eggs laid by the adults brought into the laboratory were deposited on June 4, two days after the first eggs were observed in the pasture. Throughout the season the adult *A. granarius* preferred the dung piles which had dried out and formed a hard crust over the surface. The eggs are laid just beneath this hard dry crust. By the time the dung hills had dried out sufficiently to attract the adult beetles the fly larvæ, which had been feeding and developing in the dung hills, had already pupated.

The eggs are smooth, opaque, and almost spherical or oval in shape. The average length of ten eggs was .80 mm., and the average width was .56 mm. Eggs deposited by the beetles in the laboratory hatched in four to seven days.

The newly hatched larvæ are about 2 mm. in length, and have a light brown head and white body. They have the typical shape of scarabæid larvæ, and rest with the abdomen folded against the fore part of the body as do most scarabæid larvæ. The larvæ were kept in pill boxes in small pellets of dung, but it was very difficult to maintain the proper amount of moisture for the de-

velopment. Many of them died because of too much moisture, and some died because of too little moisture. I was unable to determine the length of the various larval instars excepting the first which lasts for three or four days.

During the latter part of July the larvæ became full grown and began pupating. The first larva to pupate completed the process on July 13, while July 23 was the first date upon which the first pupa was observed in the pasture. The length of the pupal stage of specimens reared in the laboratory varied from six to ten days, with an average length of nine days.

The first adults of the new generation emerged on July 19, but the new generation of adults did not begin to emerge in large numbers until the second week in August. These newly emerged adults were much lighter in color than the parent generation, and gradually became darker up to the time of hibernation. The adults remained in the pasture feeding in the dung until fall when they hibernated.

LIST OF DIPTERA COLLECTED

(* Collected once or seldom; ** moderately abundant; *** abundant)

Psychodidæ

*** *Psychoda minuta* Banks (May to Sept.)

Sciaridæ

*** *Sciara* sp. (May and June)

Scatopsidæ

*** *Scatopse notata* Linn. (May and June)

Tabanidæ

* *Chrysops niger* Macq. (June)

Therevidæ

* *Psilocephala hæmorrhoidalis* Macq. (June)

Dolichopididæ

* *Gymnopternus* sp. (June)

Empididæ

* *Euhybos triplex* Wlk. (June)
** *Rhamphomyia mutabilis* Lw. (May and June)

Lonchopteridæ

* *Lonchoptera furcata* var. *lacustris* Mg. (June)

Tachinidæ

* *Voria ruralis* Meig. (June)
* *Metachæta helymus* Walt. (June)

Dexiidæ

* *Dinera futilis* West. (May)

Sarcophagidæ

* *Helicobia helicis* Town. (May to Sept.)
** *Sarcophaga assidua* Wlk. (May to Sept.)
** *Sarcophaga bisetosa* Park. (May to Sept.)
* *Sarcophaga cimbicis* Town. (May to Sept.)
*** *Sarcophaga communis* Park. (May to Sept.)
* *Sarcophaga sinuata* Meig. (May to Sept.)

Calliphoridæ

* *Cyanomyia cadaverina* Desv. (June and July)
* *Calliphora erythrocephala* Meig. (June and July)
** *Lucilia sericata* Meig. (June and July)

Muscidæ

** *Stomoxys calcitrans* Linn. (June to Sept.)
*** *Musca domestica* Linn. (May to Sept.)
* *Muscina stabulans* Fall. (June to Sept.)
* *Myiospilia meditabunda* Fab. (June to Sept.)

Anthomyiidæ

(All species of this family, Anthomyiidæ, were collected from May to Sept.)
** *Hebecnema umbratica* Meig.
** *Ophyra leucostoma* Wied.

** *Fannia canicularis* Linn.
** *Fannia serena* Fall.
** *Coenosia flavicoxa* Stein
** *Coenosia lata* Wlk.
** *Coenosia rufitibia* Stein.
** *Schoenomyza chrysostoma* Lw.
** *Anthomyia* sp.
** *Hammomyia johnsoni* Stein
** *Hylemyia antiqua* Meig.
*** *Hylemyia cilicrura* Rond.
*** *Hylemyia cinerella* Fall.

Scatophagidæ

* *Parellelomma pleuritica* Lw. (June)
*** *Scatophaga furcata* Say (May to Sept.)
** *Scatophaga stercoraria* Linn. (May to Sept.)

Borboridæ

*** *Sphaerocera subsultans* Fab. (May to Sept.)
*** *Leptocera frontinalis* Fall. (May to Sept.)
*** *Leptocera longicosta* Spuler. (May to Sept.)
*** *Leptocera ordinaria* Spuler. (May to Sept.)
*** *Borborus equinus* Fall. (May to Sept.)

Sciomyidæ

* *Sepedon pusillus* Lw. (June)

Ortalidæ

* *Chaetopsis fulvifrons* Macq. (June)

Sepsidæ

** *Sepsis signifera* var. *curvitibia* Mel. (May to Sept.)
*** *Sepsis violacea* Meig. (May to Sept.)
** *Nemopoda cylindrica* Fab. (May, June)
** *Meroplius stercorarius* Desv. (May, June)
** *Themira putris* Linn. (May, June)

Chloropidæ

* *Diplotoxa versicolor* Lw. (June)
* *Chlorops obscuricornis* Lw. (June)

* *Hippelates flavipes* Lw. (June)
* *Hippelates pusio* Lw. (June)
* *Hippelates subvittatus* Mall. (June)
* *Botanobia frit* Linn. (Coll. June)

Ochthiphilidæ

* *Ochthiphilia polystigma* Meig. (June)

Agromyzidæ

* *Agromyza parvicornis* Lw. (June)
* *Cerodontha dorsalis* Lw. (June)

Collections were also made in the barn where experimental animals were kept during the entire summer. The following list of Diptera includes the species taken from the barn.

Calliphoridæ

* *Cynomyia cadaverina* Desv. (June, July)
* *Calliphora erythrocephala* Meig. (June, July)
** *Lucilia sericata* Meig. (June, July)

Muscidæ

** *Stomoxys calcitrans* Linn. (June to Sept.)
*** *Musca domestica* Linn. (May to Sept.)
* *Muscina stabulans* Fall. (June to Sept.)

Anthomyiidæ

** *Fannia canicularis* Linn. (June)
** *Hylemyia cinerella* Fall (June)

Borboridæ

** *Sphaerocera subsultans* Fab. (May to Sept.)
*** *Leptocera frontinalis* Fall. (May to Sept.)
*** *Leptocera longicosta* Spuler. (May to Sept.)
*** *Leptocera ordinaria* Spuler. (May to Sept.)

Sepsidæ

*** *Sepsis violacea* Meig. (May to Sept.)
** *Meroplius stercorarius* Desv. (May, June)

Chloropidæ

* *Hippelates flavipes* Lw. (June)
* *Botanobia frit* Linn. (June)

NOTES ON THE DIPTERA COLLECTED

Psychodidæ

The larvæ of this family are found in decaying vegetable matter, in dung, or in streams. *Psychoda minuta* was very abundant around the shed and shaded places where the dung remained damp. Large numbers of the adults emerged from samples of dung exposed in the pasture. On May 20 a sample of dung was exposed for 48 hours, and on May 28 the adult *Psychoda* began to emerge. From other samples of dung exposed in the same manner the adults did not begin to emerge until after thirteen days.

Sciaridæ

The members of this family formerly belonged to the family Mycetophilidæ and are commonly known as fungus-gnats. The larvæ live in a variety of conditions: being found among decaying leaves, vegetable mold, cow dung, sheep dung, and under bark of trees. One specimen of *Sciara* was recovered on June 19 from dung exposed on June 7, requiring 12 days for its development. The adults were numerous under the shade of a tree where the sheep rested during May, but they were not captured during the latter part of the season.

Scatopsidæ

This family is closely related to the Sciaridæ, and the larvæ inhabit about the same places as the Sciaridæ. *Scatopse notata* was very common during May and June, but adults were not recovered from the samples of dung exposed.

Tabanidæ

The members of this family lay their eggs on stems of plants or exposed stones in the streams. The larvæ are aquatic or semi-aquatic, and predacious as far as is known. Some feed upon the larvæ of insects, and others upon snails.

Several specimens of *Chrysops niger* were captured near the sheep during June.

Therevidæ

This group of flies resembles the Asilidæ somewhat, both in appearance and habit. The adults are predacious, living largely upon other insects. The larvae are said to be predacious as well as feeding upon decaying vegetable and animal matter. Only one specimen of *Psilocephala haemorrhoidalis* was captured in June.

Dolichopididæ

Only one specimen of *Gymnopternus* sp. was captured, although Howard (1900) reports breeding *Diaphorus leucostomus* and *D. sodalis* from human excrement in numbers.

Empididæ

Euhybos triplex was captured in the pasture early in June by sweeping. *Rhamphomyia mutabilis* was captured about the the sheep dung during May and June. Howard (1900) captured *Rhamphomyia manca* on human feces.

Lonchopteridæ

Lonchoptera furcata var. *lacustris* was collected in the sheep pasture by sweeping with a net near the small stream which flows through the pasture. Williston (1908) states that the larvæ of flies belonging to this family live under leaves and decaying vegetable matter.

Tachinidæ

The larvæ of flies belonging to this family are parasitic, usually attacking caterpillars, but they have been reared from members of several other orders of insects. The adults live on plant juices, which probably accounts for the capture of *Voria ruralis* and *Metachaeta helymus,* as these two flies were taken during June by sweeping in the pasture.

Dexiidæ

The Dexiidæ resemble the Tachinidæ very closely in structure, habits and life history. *Dinera futilis* was the only species of this family collected. A few specimens were captured in May.

Sarcophagidæ

The flies of this family have a very wide range of habitat; some living as the family name implies in flesh, some in dung, others in decaying vegetable matter and fruits, while others are parasitic on insects, and one genus is parasitic on mammals.

Sarcophaga assidua and *S. communis* were bred from dung collected from the pasture on June 11. The adults began to emerge on June 22, eleven days after the sample was collected. On June 15 dung was exposed for 24 hours. Adults of these two species emerged on the 27th of June and continued to emerge until the 6th of July, requiring from 12 to 21 days to complete their development. *Helicobia helicis, Sarcophaga bisetosa, S. cimbicis* and *S. sinuata* were occasionally collected during the summer about the dung.

Calliphoridæ

Cyanomyia cadaverina, Calliphora erythrocephala, and *Lucilia sericata* were collected in the barn where experimental animals were kept, but were not collected in the pasture. The first two species were rather scarce during June and July, but the latter species was moderately abundant.

Muscidæ

A number of specimens of *Stomoxys calcitrans* was collected in the barn, but was not collected in the pasture, although this species breeds freely in horse manure. This species was moderately abundant from June to September. *Musca domestica* was present in large numbers during the entire season. A few specimens of *Muscina stabulans* was also taken in the barn during June, July and August.

Howard (1900) reared specimens of *Myiospilia meditabunda* from human excrement in twelve days. Specimens reared in sheep dung required eighteen days for their development. Adult flies emerged from samples of dung on June 23 and 25, which had been exposed June 5 and 7.

Anthomyiidæ

Many of the larvæ of this family breed in excrement, others in decaying animal and vegetable matter, and some are parasitic

upon other insects. Several forms have been known to produce internal myasis, retaining their vitality when taken into the stomach with spoiled vegetables and when fully developed are voided with the feces.

Thirteen species belonging to this family were collected in the pasture near the dung, but only *Hylemyia cilicrura* and *H. cinerella* were reared from the sheep dung. These two species were very abundant during the summer, while the remaining eleven species were moderately abundant.

The eggs of *Hylemyia cilicrura* and *H. cinerella* are laid in clusters in crevices of the dung, where they are often found in very large numbers. The eggs are long, cylindrical, slightly curved, and creamy white in color. They hatch in about 24 hours, and the larvæ become full grown in four to five days. These two species require nine to ten days to develop from the egg to the adult stage.

Scatophagidæ

A single specimen of *Parellelomma pleuritica* was taken in the pasture. *Scatophaga furcata* was very abundant about the sheep dung during May and June, but it was not as abundant during July and August. On June 5 dung was exposed for 24 hours from which adult *S. furcata* emerged on the 29th of June, 24 days after exposure. Another specimen of dung collected from the pasture on the same date produced adult flies 20 days later. Still another specimen collected from the pasture on June 11 produced adult flies in 15 days.

Scatophaga stercoraria was also bred from these same specimens of dung in 20 to 24 days.

Borboridæ

The flies of this family breed in almost any kind of dung. The five species represented in this list were also collected at a dump for rabbit dung and bedding where they were abundant throughout the summer.

A few specimens of *Sphaerocerus subsultans* were bred from dung exposed for two hours on June 6. The adults emerged on June 21, giving a fifteen day period for their development. Howard (1900) bred this species from human excrement in 8 days.

Wilson and Stoll (1929) have in another place noted the ease of rearing in the laboratory two species of *Leptocera* which were encountered. Several generations of *L. longicosta* and *L. ordinaria* were bred without difficulty on sterilized sheep dung. The dung was placed in pint milk bottles and male and female flies placed within them. The new generation of *L. longicosta* emerged in 11 to 14 days, the average period being 12 days, while *L. ordinaria* emerged in 9 to 10 days. Twenty newly emerged male and female *L. longicosta* were placed in shell phials upon sterilized sheep dung. The new generation began to emerge twelve days after the parent generation was placed in the phials. The average progeny of these 20 were 146.5, with a ratio of 116 males to 100 females.

Borborus equinus was bred from the sheep dung, requiring 9 to 15 days for its development.

Sciomyzidæ

A few specimens of *Sepedon pusillus* were collected by sweeping in the pasture in June. The larvæ of this family are aquatic and do not breed in dung.

Ortalidæ

The larvæ of this family have been found breeding in widely differing habitats, such as in growing plants, under the bark of dead trees, on lepidopterous larvæ, and in excrement.

Only a few specimens of *Chaetopsis fulvifrons* were captured in June.

Sepsidæ

Sepsis violacea was abundant about the sheep dung during the summer months, and was recovered from most of the samples of dung taken from the pasture. The adult flies appeared after 11 or 12 days. *Sepsis signifera* var. *curvitibia* was moderately abundant about the dung, and was bred from the dung in the same time required by *S. violacea. Nemopoda cylindrica, Meroplius stercorarius,* and *Themira putris* were moderately abundant during the latter part of May and all of June, but these species were not reared from samples of dung collected in the pasture.

Chloropidæ

Some of the larvæ belonging to this family live in the stems of grasses, some live on the egg shells and exuviæ of insects, and others live in excrement.

Six species belonging to four genera were collected in the pasture, but none of them were bred from the dung. *Hippelates flavipes* and *Botanobia frit* were also collected in the barn during June.

Ochthiphilidæ

Only one specimen of *Ochthiphilia polystigma* was captured by sweeping in the pasture in June.

Agromyzidæ

Agromyza parvicornis and *Cerodontha dorsalis* were collected during June, but were not bred from sheep dung. However, *Cerodontha dorsalis* has been bred from human excrement (Howard, 1900).

SUMMARY

A list is given of forty-three species of Coleoptera belonging to seven families, and sixty-four species of Diptera belonging to twenty-two families, collected from a sheep pasture, mostly about the dung, near Princeton, New Jersey, during the summer of 1928. It is believed that they represent a good sampling of the beetle and fly fauna of such an environment.

Of the Coleoptera included in this list the three species belonging to the genus *Cercyon* (Hydrophilidæ), *Quedius capucinus* (Staphylinidæ), and most of the species belonging to the family Scarabaeidæ were present in large numbers. These forms were also collected early in the season. Species belonging to the genus *Aphodius* were the earliest to be collected from the fresh dung. A few specimens had apparently hibernated beneath an old pile of bedding. These included many of the Staphylinidæ, *Byrrhus americanus,* two species of *Aphodius,* and *Trox insularis.*

Only one generation of *Aphodius granarius* and *A. fimetarius* was reared during the summer.

Most of the Diptera collected breed in excrement, but representatives of a few families were captured which do not breed in

dung. Many of the Diptera were collected only during the latter part of May, and during June. The Diptera reared from sheep dung required from eight to twenty-nine days for their development.

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